

Urethral Lengthening in Metoidioplasty (Female-to-male Sex Reassignment Surgery) by Combined Buccal Mucosa Graft and Labia Minora Flap

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OBJECTIVES	To develop a technique for urethral reconstruction using a combined labia minora flap and buccal mucosa graft. Urethral lengthening is the most difficult part in female transsexuals and poses many challenges.
METHODS	From April 2005 to February 2008, 38 patients (aged 19-53 years) underwent single-stage metoidioplasty. The technique starts with clitoral lengthening and straightening by division of both clitoral ligaments dorsally and the short urethral plate ventrally. The buccal mucosa graft is quilted to the ventral side of the corpora cavernosa between the native orifice and the tip of the glans. The labia minora flap is dissected from its inner surface to form the ventral aspect of the neourethra. All suture lines are covered by the well-vascularized subcutaneous tissue originating from the labia minora. The labia majora are joined in the midline and 2 silicone testicular implants are inserted to create the scrotum. The neophallus is covered with the remaining clitoral and labial skin.
RESULTS	The median follow-up was 22 months (range 11-42). The median neophallic length was 5.6 cm (range 4-9.2). The total length of the neourethra was 9.4-14.2 cm (median 10.8). Voiding while standing was reported by all 38 patients, and temporary dribbling and spraying were noted by 12. Two fistulas and one urethral erosion resulted from the testicular implant and required secondary revision.
CONCLUSIONS	A combined buccal mucosa graft and labia minora flap present a good choice for urethral reconstruction in female-to-male transsexuals, with minimal postoperative complications. UROLOGY 74: 349-353, 2009. © 2009 Elsevier Inc.

Although the phalloplasty techniques present a great challenge in female-to-male surgery, they still result in extensive scarring of the donor area. Metoidioplasty denotes one of phalloplasty's variants in female-to-male transsexuals that includes creation of the neophallus from a hormonally hypertrophied clitoris. The native female urethra is lengthened to reach the tip of the glans as in men, allowing voiding while standing, and the scrotum is created from the labia majora with 2 inserted testicular prostheses. Urethral reconstruction presents the main problem in this type of sex reassignment surgery and involves the creation of a competent urethra that allows voiding in the standing posi-

tion.^{1,2} Lebovic and Laub³ reported good results in the appearance of the external genitalia, with a more male-like configuration. Because the urethral plate remained intact, the neophallus was usually small and curved.³ Hage⁴ and Hage and Turhout⁵ reported a modification of metoidioplasty characterized by urethral lengthening, with a high complication rate in long-term follow-up. We have published the results of metoidioplasty in 22 patients, with a complication rate of 22.7%, mainly related to tubularized urethroplasty.¹ Thus, the continued challenge in the search for new and better solutions resulted in using a combined buccal mucosa graft and labia minora skin flap for urethral lengthening. This technique was based on our experience in the repair of severe forms of hypospadias.⁶

MATERIAL AND METHODS

From April 2005 to February 2008, 38 patients, aged 19-53 years (median 32) underwent female-to-male sex reassignment surgery. The patients had been treated hormonally for a mean

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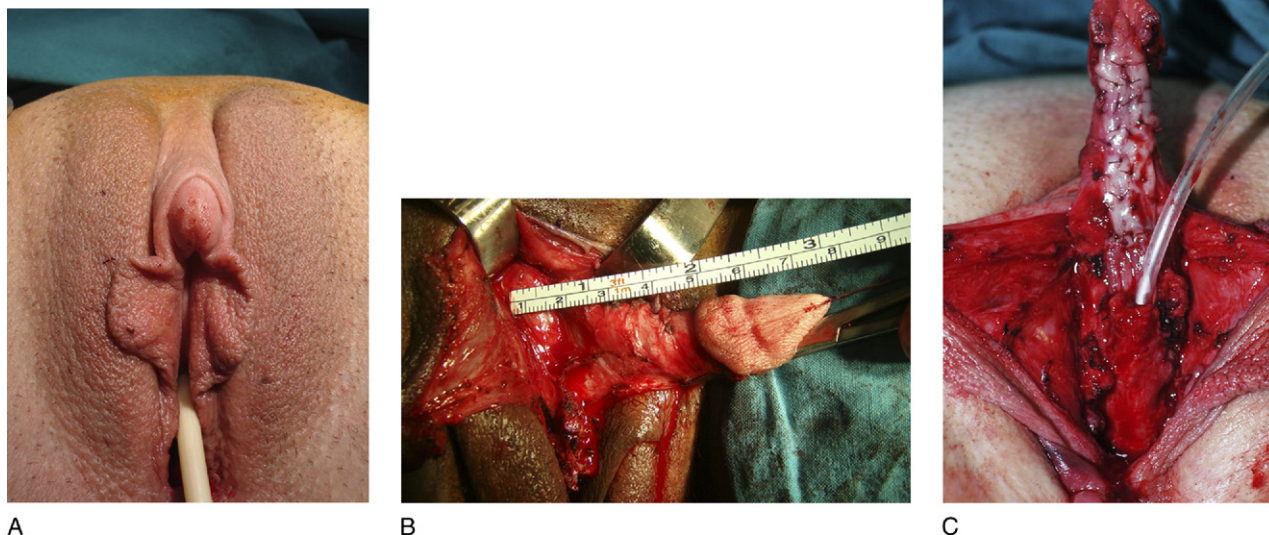


Figure 1. (A) Preoperative appearance. Clitoris hormonally enlarged. (B) Complete lengthening and straightening of clitoris achieved by division of all ligaments dorsally and short urethral plate ventrally. (C) Bulbar part of new urethra created by joining anterior vaginal wall flap and proximal part of urethral plate.

of 3.5 years (range 1.5-20) before surgery and had undergone hysterectomy and adnexectomy either before ($n = 27$) or simultaneously ($n = 11$) with metoidioplasty. Preoperatively, the clitoris was additionally enlarged using topical dihydrotestosterone gel twice daily for 3 months. An innovative vacuum erection device for additional clitoral enlargement was also used for 30 minutes twice daily. The vacuum device was created with two 50-mL syringes connected by a silicone tube, 1 of the syringes used as the cylinder engaging the clitoris and the other as the vacuum pump (Fig. 1A).

The present operative technique involved removal of the female genitalia (hysterectomy, adnexectomy, and vaginectomy), straightening and lengthening of the clitoris by division of the clitoral ligaments and the short urethral plate, urethral reconstruction using a combined buccal mucosa graft and labia minora flap, and scrotoplasty with the insertion of 2 silicone testicular implants. This approach was created from our experience and satisfactory results in numerous patients with severe hypospadias associated with penoscrotal transposition.⁶

Before phallic reconstruction, the vaginal mucosa was completely removed (colpocleisis), and the anterior vaginal wall was preserved to be used for urethral reconstruction.

Advancement of the clitoris began by circular incision of the skin at the border between the inner and outer layer of the clitoral prepuce and continued around the urethral plate and native urethral meatus. After clitoral degloving, the fundiform and suspensory clitoral ligaments were detached from the pubic bone to advance the clitoris. Ventrally, the urethral plate was dissected from the clitoral bodies with caution to prevent possible injury to the spongiosal tissue around the urethral plate and subsequent bleeding. The dissection included the bulbar part of the plate around the native meatus to enable its good mobility for the upcoming urethral reconstruction. Because the urethral plate in women is always short and causes the ventral clitoral curvature, it is mandatory to divide it at the level of the glanular corona. In this manner, complete straightening and lengthening of the clitoris can be completed (Fig. 1B).

Reconstruction of the neourethra is the most difficult part of the procedure. Reconstruction began with reconstruction of its bulbar part. A vaginal flap was harvested from the anterior vaginal wall that remained after vaginectomy, with the base close to the female urethral meatus. This well-vascularized flap was joined with the remaining part of the divided urethral plate, forming the bulbar part of the urethra. Additional urethral lengthening was done using the buccal mucosa graft and vascularized labia minora skin flap. The buccal mucosa graft was always used to cover the gap on the ventral side of the corporeal bodies after division of the short urethral plate. The graft was harvested from the inner cheek using a standard technique. The length of the graft depended on the distance between the tip of the glans and the urethral meatus. In our patients, it was 4.7-7.2 cm, and the width was 10-17 mm. Afterward, the graft was fixed and quilted to the corporeal bodies, starting from the advanced urethral meatus to the tip of the glans, thus completing the dorsal aspect of the neourethra (Fig. 1C).

The ventral part of neourethra was created as an onlay flap from the labia minora. The blood supply of the labia minora is well developed. Posterior labial artery anastomosis was done with the superficial external pudendal artery in the labia majora, with contributions from the internal circumflex artery. Multiple arterial arches in the labia minora arise from this initial arch, creating a rich blood supply that enables creation of a very long labia minora skin flap. The inner surface of 1 of the labia minora was always used for flap creation. It was dissected to create a flap with dimensions appropriate to cover the dorsal part of the neourethra. Its dissection started from the vaginal vestibulum and ran upward to the clitoral glans. The lateral wedge of the flap was defined as the border between the inner and outer labial surface. Finally, the flap was harvested by simple de-epithelialization of the outer labial skin. Thus, excellent vascularization of the flap can be preserved. Its pedicle was additionally mobilized and lengthened from the subcutaneous tissue of the appropriate labia majora to enable suturing with buccal mucosa graft without tension. The labia minora flap was

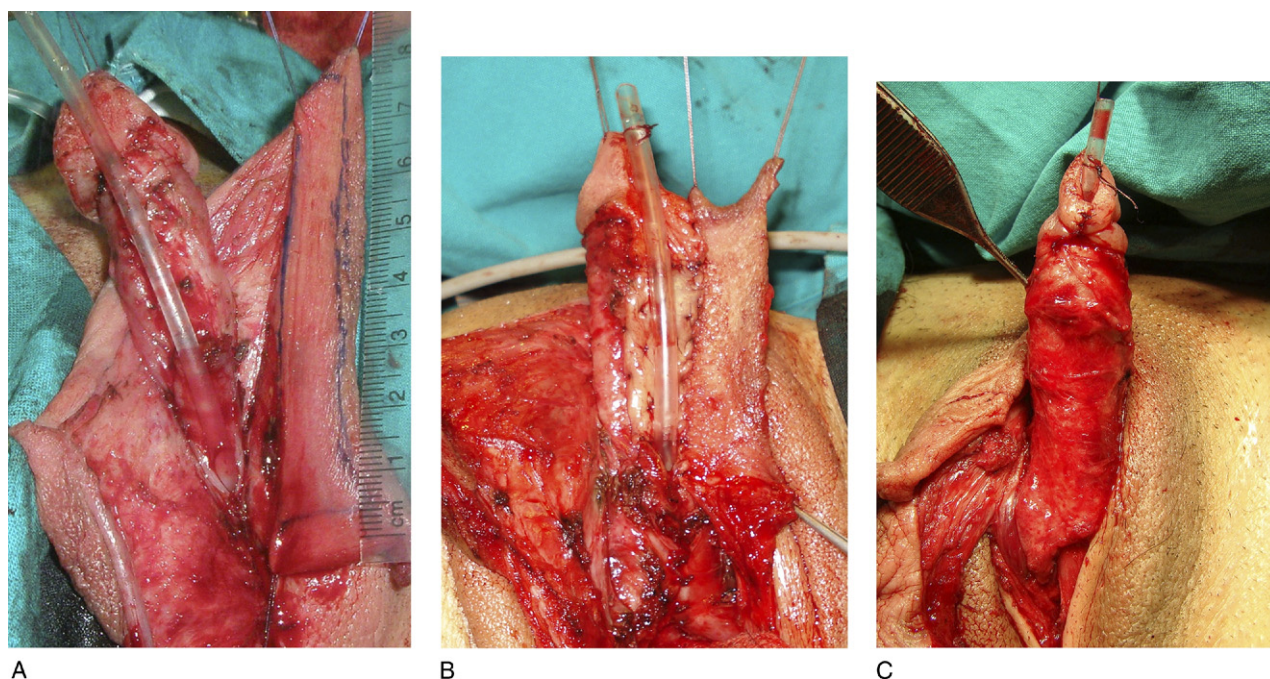


Figure 2. (A) Long flap designed at inner surface of labia minora to be harvested and mobilized by simple de-epithelialization of outer surface of labia minora. (B) Labial flap anastomosed with buccal mucosa graft, creating neourethra. (C) Abundant pedicle of flap completely covering all suture lines.

joined to the buccal mucosa graft by 2 lateral running sutures. The urethra was calibrated before closure to be not <18F in diameter. A 14F silicone tube with several holes was placed into the new urethra as a small-caliber stent to be used for buccal mucosa moisturizing and to maintain the urethral lumen. The glans was opened in the midline by 2 parallel incisions, and both glans wings were dissected extensively to enable glans approximation without tension after urethral reconstruction. Using this technique, the neourethra with the meatus placed at the tip of the glans was created. Covering the penile shaft was achieved using the remaining clitoral and labia minora skin (Fig. 2).

After closure of the vaginal space, the perineum was created to be the same as in the male. Both labia majora were joined in the midline to create the scrotum. The silicone testicular prostheses were inserted through bilateral incisions placed at the top of the labia majora, finalizing the scrotoplasty. Suprapubic urine diversion was maintained for 3 weeks. The urethral stent was removed 7 days after surgery. Broad-spectrum antibiotics and oxybutynin were given to prevent postoperative infection and bladder overactivity, respectively. Vacuum device use was recommended to all patients for a 6-month period, starting 4 weeks after surgery to prevent postoperative adhesions and subsequent shortening of the neophallus.

Postoperatively, a postal questionnaire was used that included questions about functioning and the esthetic appearance of the new genitalia from the participating subjects. Patients were asked about voiding while standing, erection quality and sensations of the neophallus, and the possibility of penetration during sexual intercourse. Satisfaction with the appearance of the new genitalia was measured using a 3-point scale (1, dissatisfied; 2, somewhat satisfied; and 3, completely satisfied).

RESULTS

The follow-up period was 11-42 months (median 22). The length of the constructed neophallus was 4-9.2 cm (median 5.6). The total length of the reconstructed urethra, including both the bulbar and the penile urethra, was measured during surgery and was 9.4-14.2 cm (median 10.8). The length of the neophallus was not a limiting factor for voiding while standing, which was reported by all 38 patients. According to the patient self-reports, most were pleased with the esthetic appearance of their genitalia (36 "completely satisfied and 2 somewhat satisfied"). In 14 patients who reported sexual intercourse, the length of the neophallus was inadequate for full penetration. Nevertheless, erection of the clitoris, with its completely preserved sensation, was reported by all of them (Fig. 3).

The complications were divided into minor (could be managed nonoperatively) and major (required additional surgery). Minor complications included dribbling and spraying during voiding and were reported by 12 patients. These had spontaneously resolved 3 months after surgery in all cases.

The major complications were also related to the urethral reconstruction. Two fistulas and one urethral erosion were caused by pressure from the testicular implant. Both fistulas were closed with a minor procedure. In the third case, the damaged urethra was sutured and the testicular implant was simultaneously replaced in new scrotal pocket. In all 3 cases, repair was successful, and normal voiding was obtained without urinary leaks. Voiding cystourethrography 6 weeks later confirmed a

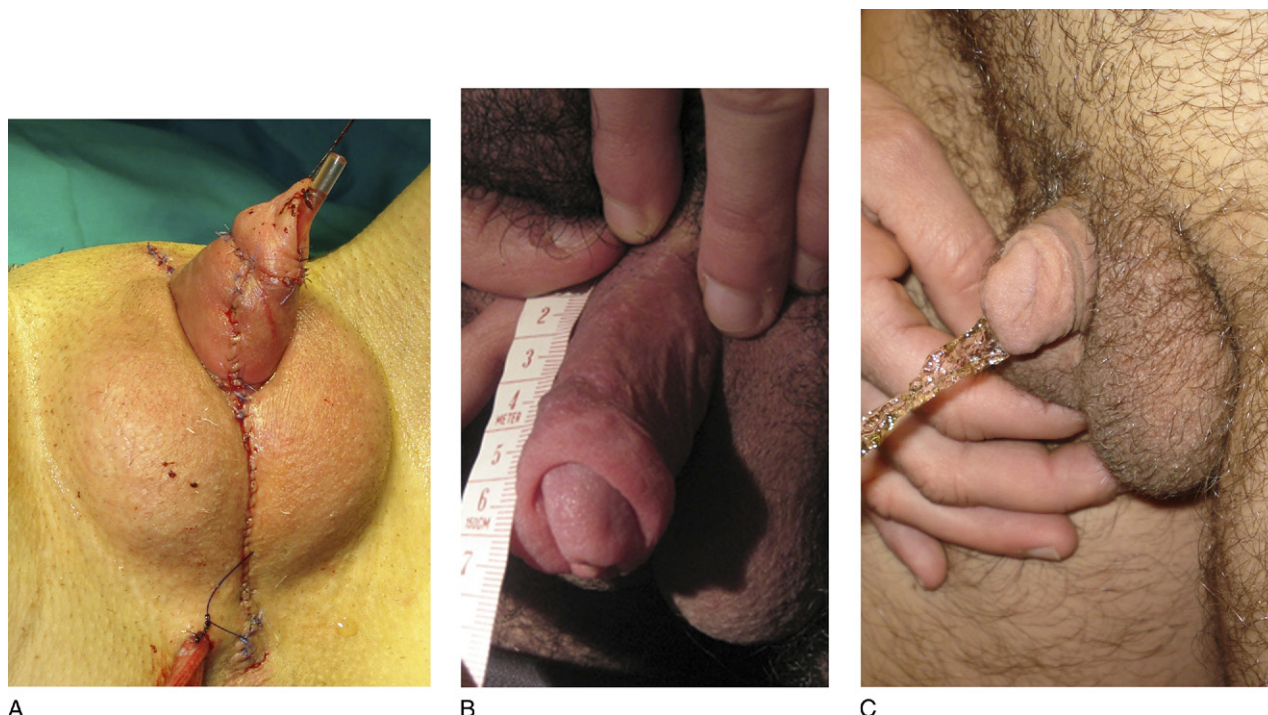


Figure 3. (A) Appearance at end of surgery. Penile skin reconstruction performed using remaining available clitoral and labia minora skin. Two testicular implants inserted into scrotum created from both labia majora. (B) Outcome 2 years later showing 7-cm length neophallus and scrotum with testicular implants with normal configuration. (C) Voiding while standing achieved.

good urethral silhouette, without a postvoid residual urine volume (Fig. 4).

No other complications were related to the buccal mucosa harvest site and no postoperative bleeding, flap necrosis, or infection developed.

COMMENT

Creation of the neophallus is one of the most difficult parts in the treatment of female-to-male transsexuals. Although a variety of surgical techniques are available, their results are not similarly acceptable to all patients. Metoidioplasty is a technically demanding, as well as challenging, surgical procedure used in female-to-male transsexuals, who have chosen sex reassignment surgery without undergoing the complex, multistage surgical creation of an adult-size phallus. It is viable in patients in whom the clitoris seems large enough after androgen hormonal treatment to provide a phallus that will satisfy the patients' wishes.¹

During the development of transsexual surgery for female-to-male transsexuals, the creation of a competent neourethra that allows voiding in the standing position was one of the main goals.² Lebovic and Laub³ reported good results in the appearance of the external genitalia, with a more male-like configuration. In their series, because the urethral plate remained intact, the neophallus was usually small and curved.³ Hage⁴ published a modification of metoidioplasty, characterized by urethral lengthening. The neourethra was created from labia minora flaps and the urethral plate, which was divided at

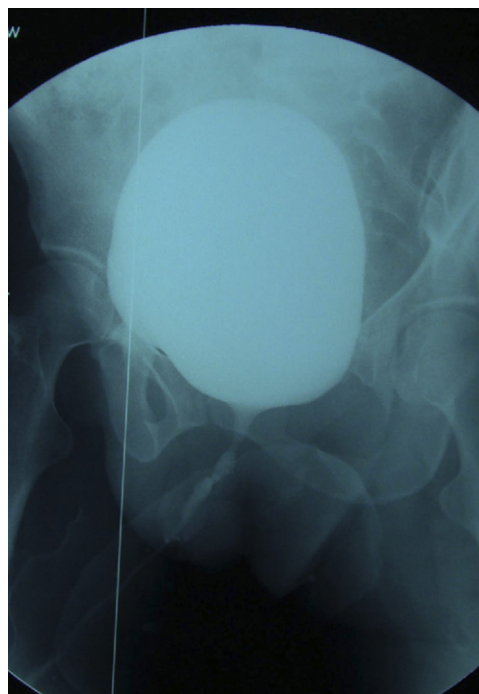


Figure 4. Patient required urethral reconstruction because of urethral erosion caused by testicular implant pressure. Voiding cystourethrogram showing good urethral silhouette after revision.

the level of the female opening. Because the course of dissection was from proximally to distally, it could compromise the vascularization of the mobilized urethral plate. During long-term follow-up, Hage and Turnhout⁵

reported a high complication rate with one-stage repair that was especially related to reconstruction of the urethra and concluded that in 70 treated female-to-male transsexuals, an average of 2.6 procedures per patient was needed for complete genital reassignment.

Our previously reported results using the technique of Lebovic and Laub with the modification by Hage revealed lower complication rates.¹ To overcome the disadvantages of the reported techniques of metoidioplasty, we continued to search for a better solution. We used a combined buccal mucosa graft and labia minora skin flap to avoid the complications described after tubularized urethroplasty. Our decision was based on our experience in the treatment of the most severe forms of hypospadias.⁶ The use of a buccal mucosa free graft in urethral reconstruction is becoming more and more accepted in certain clinical settings.⁷ The grafts are tough, elastic, easy to harvest, and easy to handle and leave no visible scar at the donor site. Their histologic structure makes them good grafting material.⁸ Quilting of the buccal mucosa as a dorsal inlay graft on corporal bodies enables better graft survival. Also, a well-vascularized recipient site will provide a good blood supply and prevent contractions of the graft. Additional urethral reconstruction was accomplished using a skin flap originated from the inner layer of the labia minora. This graft is a hairless, naturally wet, elastic, and easily available tissue. The blood supply of the labia minora comes from the external superficial pudendal artery and internal pudendal artery. The outer well-vascularized pedicle of the labia minora flap completely covered all suture lines, preventing fistula formation.⁹

One of the advantages of this technique is the use of an anterior vaginal wall flap in the reconstruction of the bulbar urethra. The urinary stream is strongest at the bulbar urethra, which therefore, is the site with a high risk of fistula formation in the postoperative period. Joining the clitoral bulbs over the lengthened urethra, with additional covering using the remaining surrounding vascularized tissue, was considered key to successful fistula prevention.

All our patients underwent single-stage surgery. Complications related to urethroplasty occurred in 15 patients, mostly related to dribbling and spraying during voiding (12 patients). These complications resulted from removal of the anterior vaginal wall, which is close to the

bladder neck and female urethra; however, the dribbling and spraying resolved spontaneously. In the other 3 patients (7.9%), urethral reconstruction was needed.

Most patients were satisfied with the final outcome of metoidioplasty, because the appearance of male genitalia and voiding while standing were achieved. However, the length of the neophallus was not adequate for penetration during sexual intercourse. Different types of augmentation phalloplasty could also be used, according to the patient's sexual preferences. Longer term outcomes of the technique and the evaluation of patient satisfaction with the quality of the psychosocial and psychosexual life are anxiously awaited.

CONCLUSIONS

Metoidioplasty as a one-stage sex reassignment procedure for female-to-male transsexuals is a safe and time-saving surgical procedure. It is an alternative for patients wishing to change their external genitalia to the male and to void while standing. Complex and advanced urethroplasty using a combined buccal mucosa graft and labia minora flap represents a good choice and an effective procedure with lower complication rate compared with previously reported techniques.

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